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GENERAL NOTES.

Stellar Photometry.—Publication No. 33 of the Carnegie Institution of Washington, "Researches in Stellar Photometry," by JOHN A. PARKHURST, Instructor in Practical Astronomy in the University of Chicago, was issued during November of the year just closed. The quarto volume of 192 pages contains observations and discussions of twelve variable stars of long period observed by Mr. PARKHURST between 1893 and 1905. During the first seven years the observations were made mostly at Marengo, Illinois, with a 6-inch Newtonian reflector by BRASHEAR. Since 1900 Mr. PARKHURST has been connected with the Yerkes Observatory, and the 12- and 40-inch refractors of that institution were used in addition to the 6-inch reflector. During the first period the observations were made visually by the method of ARGELANDER, but during the second period a wedge photometer, devised by Professor E. C. PICKERING, was used for the most part.

In the introduction the author states that his work is addressed to the solution of four problems in photometry, and the statement of these is admirably prefaced as follows:—

> "The problems of stellar photometry are closely connected with many cosmic questions, primarily with the light changes of variable stars; but they have an equally important bearing on the questions of stellar distribution and evolution. It has been said by good authorities that it is of more importance to measure the light than the place of a star, and if one considers merely the astonishing number of variable stars now being discovered, it will be admitted that the importance of stellar photometry can scarcely be overestimated. The material here submitted is the natural outgrowth of the writer's variable-star work, the plans being extended as the instrumental and other facilities were improved.
>
> "The following contribution is offered toward the solution of several photometric problems, among them being:—
>
> "(1) The accurate determination of complete light-curves of twelve variable stars of long period, having faint minima.
>
> "(2) The question of behavior of variable stars during their faint stages which can only be observed with the largest apertures.
>
> "(3) The adaptation of the Pickering 'equalizing wedge photometer' to the determinations of magnitudes.
>
> "(4) The photometric measurement of very faint magnitudes, and their relation to estimates founded on the limit of visibility of different apertures of telescopes."

Under the headings "Essentials for good visual comparisons" and "Essentials for good photometer measures," Mr. Parkhurst gives also in the introduction some very wholesome advice which it would be well for all variable-star observers to read.

Chapter I is devoted to a description of the instruments used, and especially to the consideration of the constants of the equalizing wedge photometer.

The following twelve chapters are devoted one each to the twelve variable stars observed,—T *Andromedæ,* V *Andromedæ,* W *Andromedæ,* R *Comæ,* RU *Herculis,* RV *Herculis,* S *Lyræ,* S *Cygni,* SX *Cygni,* V *Delphini,* Z *Cassiopeiæ,* Y *Cassiopeiæ.* These are for the most part new variables discovered during the last decade of the nineteenth century. Each chapter contains a short historical statement; a photograph of the field of the variable made with a 24-inch reflector; various tables giving the individual observations, the comparison-stars, constants for reduction, observed maxima and minima, etc.; the magnitude-curve; the light-curve; the mean light-curve; and conclusions giving period of star and peculiarities of its light-curve. The observations and reductions have been made with minute care and great thoroughness, and it is evident from the tests applied that the results obtained by Mr. Parkhurst are possessed of a high degree of precision.

The magnitudes of the stars observed lie between 7.5 and 17, the greatest range of any one variable, V *Delphini,* being nine magnitudes, from 8 to 17, a really remarkable range. The only other variable having an observed range of more than 7.5 magnitudes being χ *Cygni,* 4.5 to 13.5. The average range for the twelve stars is 5.8 magnitudes. The periods of these lie between 259 and 529 days, the average being 362 days. A large number of long-period variables have periods approximately a year in length, and the average period is over three hundred days and apparently approaching closer to a year. It seems hardly likely, however, that these facts have any special significance.

It is well known that in stars of this class the increase in light is accomplished in less time than the decrease, the ratio between the two parts of the period being about five to six. This feature is well shown in the light-curves of all the twelve stars observed by Parkhurst, except S *Cygni,* for which

M — m is almost exactly one half the period. The inequality between increase and decrease of light is greatest for V *Delphini,* the ratio being about five to eight. Its period is 529 days, one of the longest known. This star shows, then, three distinctive characteristics among the twelve stars, its period is the longest, its range is the greatest, and the inequality between the two parts of the period is the largest.

The elements obtained by the author for the twelve stars are derived from observations of ninety-five maxima and ninety-three minima. The observations, however, were not confined to the epochs of maxima and minima, but were carried on, as far as possible, over the whole period, and the special feature of the volume is the well-determined mean light-curves which have been derived in each case. It is now generally recognized among variable-star investigators that it is just as essential to determine the *form* of the light-curve as to determine the length of the period. Several good series of variable-star observations from which light-curves may be deduced have been published without graphic representation of the curves, and the usefulness of the investigations considerably decreased thereby.

In the concluding chapter there is given, among other things, a comparison between the theoretical and the observed limits of vision of the three telescopes employed in the investigations. The theoretical limits were computed by the use of POGSON'S well-known formula and the agreements are remarkably close. The seventeenth magnitude is the limit of the giant 40-inch refractor.

It is to be hoped that Mr. PARKHURST may be able to continue in this line of work, for investigations such as these, planned with care, executed with skill, discussed with precision, are most urgently needed in variable-star astronomy.

S. D. T.

Double-Star Orbits.—By his long-continued devotion to the study of double stars and by the quality of the many orbits he has published, Dr. W. DOBERCK has well earned his position as one of the leading authorities in this branch of astronomy. That his interest does not diminish with the years is evident from the number of his investigations that have recently appeared. The latest (*Astronomische Nachrichten,* 4144-4145) are new orbits of three of the best known of the binary systems,—namely, *ζ Cancri,* *ω Leonis,* and Σ 3062 = H I 39.

There are other recent orbits of all three of these systems that represent the observed motion up to the present time with a high degree of accuracy, and it is perhaps questionable whether so much labor as is represented by these new discussions was wisely bestowed. Nevertheless it is always interesting and instructive to compare the results obtained by different computors, using different methods of solution, especially when, as in the case of the three stars named, the orbits are based substantially on the same material. The periods of the three systems, according to DOBERCK, are 116, 105, and 60 years respectively, and the motion is not specially rapid at the present time in any one of them. The new elements of *ω Leonis* and Σ 3062 do not differ materially from the other recent orbits, and only serve as additional evidence that our knowledge of the motions in these systems is now fairly accurate. In the case of *ζ Cancri,* Dr. DOBERCK's results differ more from SEELIGER's than might be expected, in view of the fact that the latter represent recent observations within the probable error of measure.

The two sets of elements are as follows:—

	P.	T.	*e*	*a*	ω	Ω	*i*
SEELIGER:	59^{y}.11	1868.11	0.381	0″.858	250°.26	80°.19	11°.14
DOBERCK:	60 .08	1870.65	0.339	0 .856	183 .65	.....[1]	0 .00

Angles decreasing.

If one might venture any criticism upon such painstaking work as Dr. DOBERCK'S, it would be on the ground that he does not make much use of the measures of distance, basing his results almost exclusively upon the angle measures. The question might also be raised whether elaborate least-squares solutions are justified by the quality of the material available, but this question will be answered in due time by the way in which the results thus derived represent the future motions in these systems. A.

On Star Streaming.—At a meeting of the British Association for the Advancement of Science held at Cape Town, South Africa, August 17, 1905, Professor J. C. KAPTEYN read a paper with the above title. It cointained an announcement of the results of a study of the proper motions of over 2,400 stars observed by BRADLEY.

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[1] The planes of the true and of the apparent orbit coincide in this solution.

The study was taken up for the information it was expected to yield regarding the motion of the Sun among the stars, but certain anomalies appeared which seemed to indicate the existence of an important and hitherto unsuspected systematic motion among the stars under investigation. It appeared that the proper motions showed a trend toward two points in the sky about 140° apart, lying south of *α Orionis* and *η Sagittarii* respectively.

The explanation offered is that a large number of stars distributed throughout all of the regions of the sky covered by the Bradley catalogue partake of a common, or group, motion peculiar to themselves. All of the stars under investigation seemed to belong to one or the other of two groups.

This introduces a complication into the problem of determining the apex and velocity of the Sun's way, and Professor KAPTEYN desires confirmation from spectroscopic observations before proceeding to the completion of his study.

A subsequent study by Mr. A. S. EDDINGTON of the proper motions of the stars contained in the Groombridge catalogue has quantitatively confirmed Professor KAPTEYN'S conclusion. The 4,500 stars of the Groombridge catalogue include a much larger proportion of faint stars than the Bradley list, and they lie within a smaller area of the sky, all being within 52° of the North Pole. Mr. EDDINGTON concludes that the two-drift hypothesis is a good first approximation to the actual state of affairs, but he is by no means convinced that there may not be other drifts involving a sufficiently large number of stars, and so distributed that account will have to be taken of them in the solution of the problem of determining the Sun's motion among the stars. An abstract of Mr. EDDINGTON'S paper may be found in *Observatory* No. 377. N.

Algol Variable RR Draconis.—In *Bulletin* No. 9 of the Laws Observatory of the University of Missouri Professor SEARES presents the results of photometric observations of an interesting new variable of the *Algol* type, RR *Draconis*. The period is found to be 2.831079 days. At normal brightness the variable is of the tenth magnitude, and the decrease in brightness at the time of minimum is over three magnitudes. The exact amount of decrease could not be determined with the telescope employed, for the star was invisible for a period of about two hours in the neighborhood of the minimum. The time occupied in the light changes is about ten hours. The rate of change of light at the steepest part of the curve is over a magnitude in half an hour.

This star at minimum is fainter than any other *Algol* variable listed in the Harvard Provisional Catalogue of Variable Stars. Its range of brightness is also greater than that of any other variable of this type, the average range being 1.4 magnitudes. S. D. T.

National Academy of Sciences.—The autumn meeting of the National Academy of Sciences was held November 20th, 21st, and 22d in the buildings of the Harvard Medical School, Boston. Among the large number of papers presented five were upon astronomical subjects, as follows: "The Work of the Bruce Telescope," by S. I. BAILEY, of Harvard University; "Present State of Knowledge as to Motions of the Terrestrial Pole," by S. C. CHANDLER, Editor of the *Astronomical Journal;* "Extent and Structure of the Stellar System," by G. C. COMSTOCK, of the University of Wisconsin; "Sun-Spot Spectra, and Their Bearing on Stellar Evolution," by G. E. HALE, of the Solar Observatory of the Carnegie Institution; "Planetary Inversion and the Tenth Satellite of *Saturn,*" by W. H. PICKERING, of Harvard University.

At the *conversazione* held in connection with the meeting, photographs, slides, and drawings were presented by the Harvard College Observatory and by the Solar Observatory of the Carnegie Institution.

The following notes have been taken from recent numbers of *Science*:—

Professor CHARLES LANE POOR, of Columbia University, gave a public lecture under the auspices of the New York Academy of Sciences and the American Museum of Natural History, on November 19th, on "The Proposed New Astronomical Observatory and Nautical Museum for New York City."

Dr. WILLIAM H. BROOKS, Director of Smith Observatory and Professor of Astronomy at Hobert College, Geneva, N. Y., has received a medal from the Astronomical Society of Mexico for his discoveries of twenty-five comets.

Professor RAJNA, of Bologna, is making an appeal for funds to rebuild the observatory there on a new site, and to provide it with instruments suited to modern requirements.

Professor ERNEST W. BROWN, who goes at the end of the present academic year from Haverford College to Yale University, has been awarded the gold medal for 1907 by the Royal Astronomical Society for his work on the movements of the Moon.

Mr. SYDNEY S. HOUGH, chief assistant in the Royal Observatory, Cape of Good Hope, has been appointed His Majesty's Astronomer at that observatory on the retirement of Sir DAVID GILL.

Dr. SIDNEY DEAN TOWNLEY, astronomer in charge of the International Latitude Observatory at Ukiah, California, and lecturer in astronomy in the University of California, has been appointed to an assistant professorship in the department of applied mathematics at Leland Stanford Junior University. Dr. TOWNLEY will assume the duties of his new position with the beginning of the next academic year in August.